Heat Pumps for Efficient and Flexible Heat Supply in Copenhagen

Elmegaard, Brian; Bühler, Fabian; Jensen, Jonas Kjær; Jørgensen, Pernille Hartmund; Mancini, Roberta; Markussen, Wiebke Brix; Meesenburg, Wiebke; Ommen, Torben Schmidt; Pieper, Henrik; Rothuizen, Erasmus Damgaard

Total number of authors:
11

Published in:
Book of Abstracts, Sustain 2017

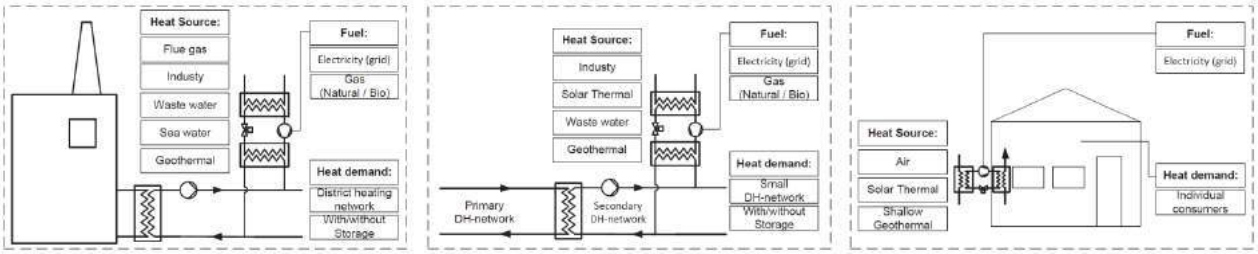
Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

Heat Pumps for Efficient and Flexible Heat Supply in Copenhagen

Brian Elmegaard*[1], Fabian Bühler[1], Jonas Kjær Jensen[1], Pernille Hartmund Jørgensen[1], Roberta Mancini[1], Wiebke Brix Markussen[1], Wiebke Meesenburg[1], Torben Ommen[1], Henrik Pieper[1], Erasmus Rothuizen[1], Benjamin Zühlsdorf[1]

1: DTU Mechanical Engineering, Section Thermal Energy
*Corresponding author email: be@mek.dtu.dk



Danish society plans to be completely independent of fossil fuels in 2050. This will involve significant expansion of renewables, in particular wind and solar power, which implies that electric power may be the main energy carrier of the energy system. Copenhagen city's heat plan includes scenarios that will require up to 300 MW installed heat pump capacity. Such expansion will require considerable changes of the system which opens large potentials for innovative solutions both regarding dimensioning, design and operation of the installed heat pumps. In addition to supporting the electrification of the energy system, heat pumps are highly efficient and may support integration of excess heat, e.g., from industry, and benefit the electricity system by providing flexibility in terms of ancillary services for the electricity system.

In addition to the significant potentials heat pumps may provide, a large expansion of the technology also requires solution of a number of challenges. These include:

- Socio- and private economic competition with alternative technologies
- Access to low temperature heat sources at low cost both in terms of energy and capacity
- Development of component technology for the heat pumps, e.g. compressors
- Design, configuration and control of large-scale heat pump units with high Seasonal Coefficient of Performance, SCOP
- Access to appropriate refrigerants with low cost and environmental impact
- Integration in the existing district heating system by optimization of operating temperatures and utilization of heat storage
- Development of solutions with high flexibility in terms of load change for integration with the electricity system

The poster presents results of projects related to solving technical challenges for heat pump integration in Copenhagen's heat supply. The work is sponsored by the Danish Energy Agency's EUDP program and Innovation Fund Denmark.